Precision Time Protocol Based Trilateration for Planetary Navigation, Phase II

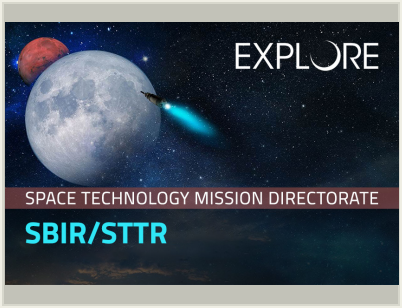
Completed Technology Project (2009 - 2011)

Project Introduction

NASA's vision for planetary exploration requires development and field testing of the key technologies required for extended habitation. To support extended lunar operations with technologies directly extensible to the Mars environment, a high fidelity navigation system is needed. Precision localization and route mapping is required for planetary EVA, manned rovers and lunar surface mobility units. The innovation is the establishment of a fault tolerant, field scalable, high precision navigation system that can and support the size, weight, and power (SWaP) goals by integrating mature technologies to provide an navigation capability while naturally supporting data and voice communications on the same network. Perhaps most importantly, this system is bidirectional such that position information is provided to both the base and the mobile units. Such a system provides a precise and reliable navigation backbone to support traverse-path planning systems and other mapping applications and establishes a core infrastructure for long term occupation.

Anticipated Benefits

The proposed approach will have other military and commercial applications in the terrestrial environment. Modernization of the aging international LORAN infrastructure with a lower power more accurate digital solution stands out as a key cross-promotion for this system. There is strong domestic and international support for retaining and modernizing the LORAN infrastructure as a backup to GPS. LORAN remains a critical navigational aid for merchant ships, especially in port ingress during heavy storms where GPS is not available. Modernization of domestic and foreign air traffic control systems with a highly precise and reliable air traffic and runway monitoring system is also a large opportunity for this technology. The integration of the IEEE1588 time standard with the Sensis MDS product is expected to improve the accuracy and useful range of the system as well as reducing the cost and complexity of the system. NASA commissioned a Lunar Architecture Team (LAT) to develop a baseline architecture concept for lunar habitation. Communications and Navigation are two of the key focus elements of this architecture concept which are addressed by his topic. This system will be used primarily in planetary habitation, exploration, and mining but also has applications in landing systems for lunar, terrestrial, or Mars reentry. We expect NASA to use this technology for initial development of a lunar base and to support exploration and mining activities on the moon. Later the same technology may be used to perform these functions with only minor modifications during future planetary exploration.



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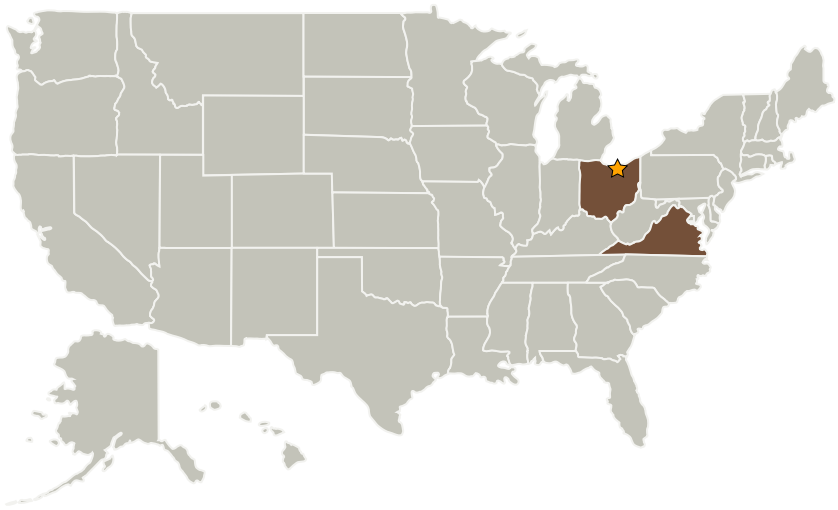
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Progeny Systems Corporation	Supporting Organization	Industry	Manassas, Virginia

Primary U.S. Work Locations	
Ohio	Virginia

Project Transitions

December 2009: Project Start

June 2011: Closed out

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

David T Chelmins

Principal Investigator:

Ron Murdock

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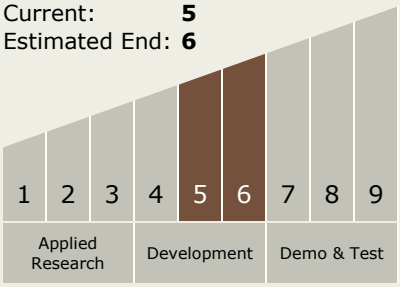
Technology Maturity (TRL)

Start: **5**
Current: **5**
Estimated End: **6**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.2 Resource Acquisition, Isolation, and Preparation